The Stratigraphic Succession in Missouri

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the Paleozoic Systems up to and including the Pennsylvanian. In the southeastern part of the state, in the lowland area, the rock succession is thicker but most of the Paleozoic Systems are missing. As much as 4,700 feet of post-Precambrian rock has been penetrated by one of the deepest wells in the area, but only the deepest part of this well is in Paleozoic rock of Cambrian age. The balance of the succession is composed of Cretaceous and Teritary rocks.

The structural attitude of the Paleozoic rocks throughout the state is controlled principally by the shape of the Ozark uplift, the apex of which forms the core of the St. Francois Mountains. Paleozoic strata dip away in all directions from the periphery of the St. Francois Mountains into surrounding structural basins: the Forest City basin to the northwest, the Illinois basin to the northeast, the Anadarko basin to the southwest, the Arkoma basin to the south, and the depression of the Mississippi Embayment to the southeast. Some of the more prominent secondary structural features which locally affect the attitude of Paleozoic strata within the state are the Lincoln fold in northeastern Missouri, the Mineola arch in central Missouri, the Cap au Gres fault north of St. Louis, the Little Saline fault complex in Ste. Genevieve County, and the Chesapeake fault zone southwest of Springfield.

Cambrian System

by

William C. Hayes and Robert D. Knight

Upper Cambrian Series

All the Cambrian strata in Missouri are regarded as Late Cambrian in age. The unconformity at the base of the Series is particularly striking in the St. Francois Mountain area where prominent ridges and knobs of Precambrian granite and felsite are in contact with Cambrian strata. The lower part of the Series consists of a quartzose sandstone, the upper part of dolomite and shale. Exposures of the sandstone are generally limited to the St. Francois Mountain area where they onlap the flanks of Precambrian knobs. Outcrops of successively higher units occur in peripheral, annular patterns around the area. Away from the uplift, Upper Cambrian formations dip beneath younger Paleozoic strata and are present in the subsurface throughout the state except in those areas where they have overlapped Precambrian topographic highs and have been subsequently removed by erosion.

The combined thicknesses of the strata which form the Upper Cambrian Series in Missouri total approximately 2,000 feet. The Series contains six formations, two of which form a group. In order of decreasing age, they are as follows: the Lamotte, Bonneterre, Davis, Derby-Doerun, Potosi, and Eminence formations; the Davis and Derby-Doerun together form the Elvins group.

Lamotte formation.—The Lamotte is predominantly a quartzose

sandstone that in many places grades laterally into arkose and conglomerate. Pebbles and boulders of felsite are the chief constituents of the conglomerates which immediately overlie Precambrian rocks in many places. The color of the sandstone ranges from light gray or white to yellow, brown, or red. Red to purple silty shale is locally present, and lenses of arenaceous dolomite are scattered through the upper part of the formation.

The Lamotte attains its maximum thickness of about 500 feet in the depressions between Precambrian ridges and knobs. Where the formation onlaps these knobs and hills, it pinches out and is overlapped by younger formations.

Exposures of Lamotte are in general restricted to the St. Francois Mountain area in Madison, Ste. Genevieve, Iron, and southeastern Washington Counties. The Lamotte appears to be absent in west-central Madison County. The formation is persistent in the subsurface throughout Missouri except on Precambrian highs where younger formations overlap it. Regional variations in thickness of the Lamotte within the state are indicated by the following data: In Howell County the formation is approximately 200 feet thick, in Laclede County it is 300 feet thick, in Barry County, 125 feet, and in Ralls County, 340 feet. In Nemaha County, Nebraska, across the Missouri River from Atchison County in northwestern Missouri, it is 65 feet thick.

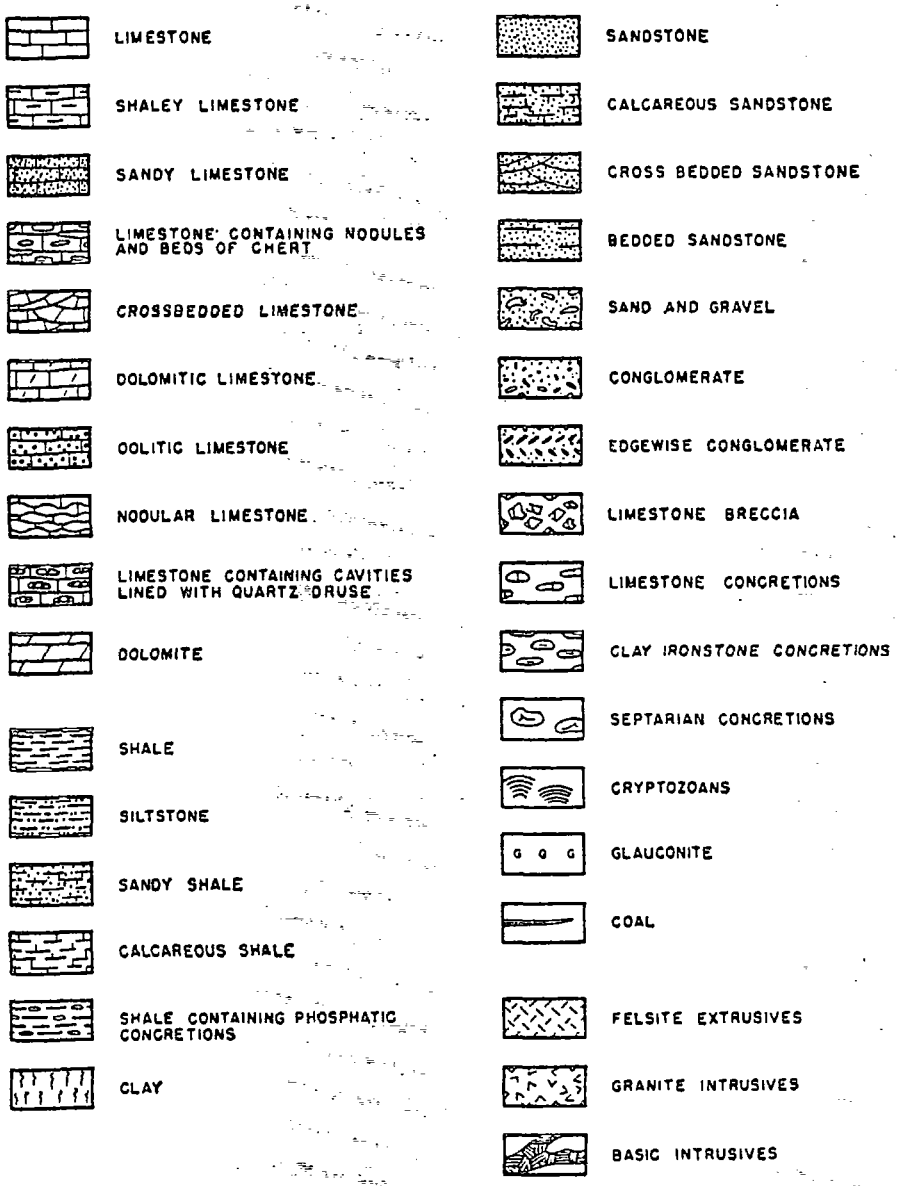
The Lamotte is quarried for dimension stone in the St. Francois Mountain area.

Bonneterre formation.—The Bonneterre is typically a light gray, medium- to fine-grained, medium-bedded dolomite but consists of relatively pure limestone in some areas. In places, it is very coarse grained, and it contains small cavities which are lined with dolomite rhombs. Locally, parts of the Bonneterre are glauconitic and shaly with the shale occurring in beds less than 2 inches thick. In some areas, the formation contains beds of relatively pure, thin-bedded, pink limestone which is referred to as "Taum Sauk marble".

In the Fredericktown area, the formation has been divided into six units on the basis of insoluble residues. In the Lead Belt, eight principal units are recognized, although all are not identifiable at any one locality. Because of the importance of the formation as a host rock to the ore deposits of the Lead Belt, the Bonneterre has been studied in more detail there than elsewhere. Structures that are important as ore controls are: clastic carbonate bars or ridges, algal structures, and masses of submarine breccia. Major lead production to date has been from the lower half of the formation. Wherever the Bonneterre has been deposited near or directly on the Precambrian surface, it contains pebbles and cobbles of igneous rock much of which is felsite. The host rock at the St. Joseph Lead Company's Hayden Creek mine is a granite conglomerate cemented by dolomite. The ore is present in the dolomite and fills fractures in the granite boulders.

The relationship of the Bonneterre and the underlying Lamotte is one of conformity. The lower part of the Bonneterre consists of alternating beds of dolomite and arenaceous dolomite with the amount

LEGEND


LIMESTONE
SHALEY LIMESTONE
SANDY LIMESTONE
LIMESTONE CONTAINING NODULES AND BEDS OF CHERT
CROSSBEDDED LIMESTONE
DOLOMITIC LIMESTONE
OOLITIC LIMESTONE
NODULAR LIMESTONE
LIMESTONE CONTAINING CAVITIES LINED WITH QUARTZ DRUSE
DOLOMITE
SHALE
SILTSTONE
SANDY SHALE
CALCAREOUS SHALE
SHALE CONTAINING PHOSPHATIC CONCRETIONS
CLAY
SANDSTONE
CALCAREOUS SANDSTONE
CROSS BEDDED SANDSTONE
BEDDED SANDSTONE
SAND AND GRAVEL
CONGLOMERATE
EDGEWISE CONGLOMERATE
LIMESTONE BRECCIA
LIMESTONE CONCRETIONS
CLAY IRONSTONE CONCRETIONS
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COAL
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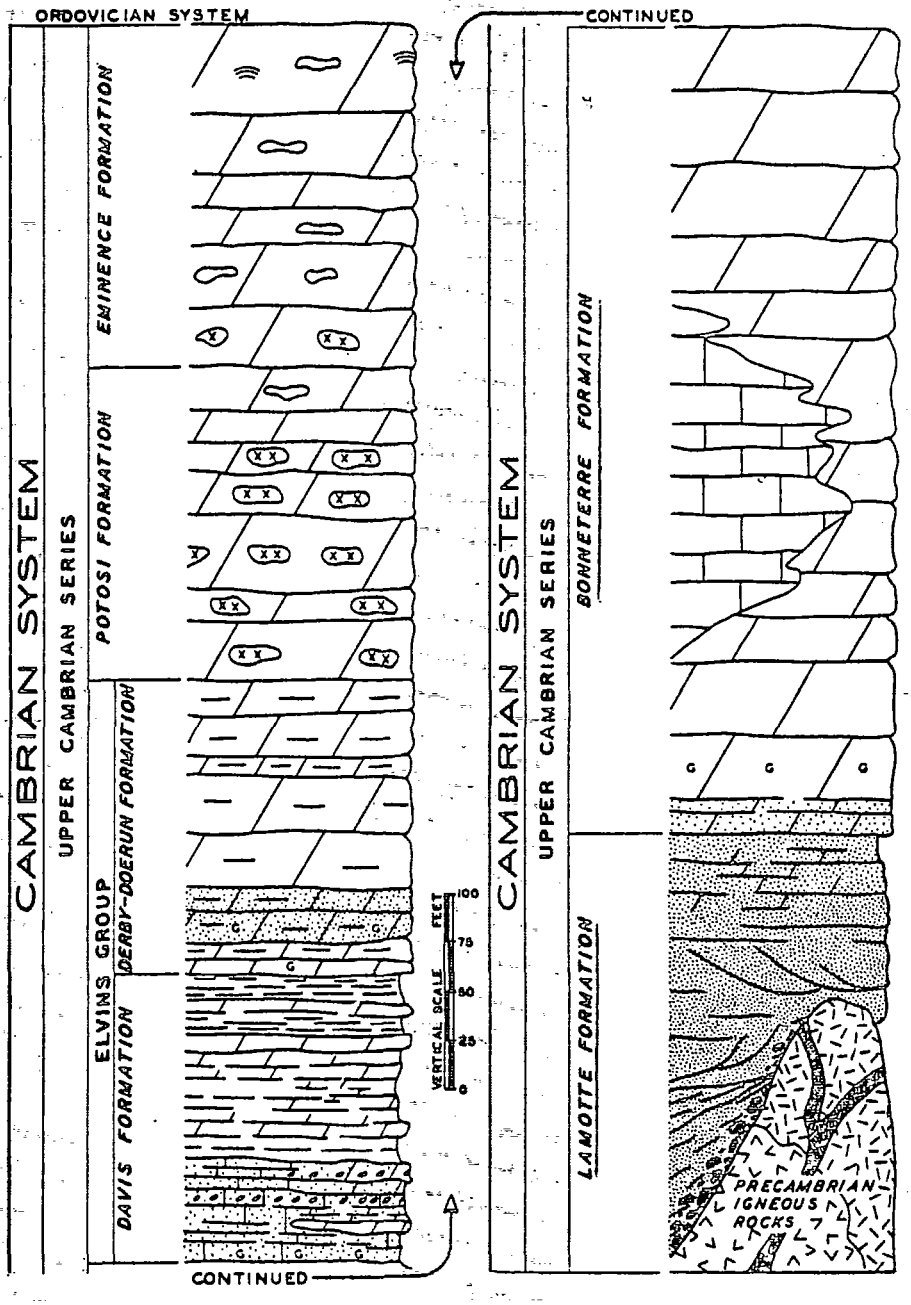

Fig. 3. Cambrian System; Upper Cambrian Series.

of sand increasing toward the base. This sandy zone is usually 10 to 20 feet thick but may approach a thickness of 200 feet. The Bonneterre overlaps the underlying Lamotte on the flanks of Precambrian highs.

Most of the Bonneterre exposures lie to the north and east of the main area of Precambrian exposures, and the formation is concealed by younger beds to the west and south. It occurs in the subsurface throughout most of the state and attains a maximum known thickness of 1,580 feet in the subsurface in Pemiscot County. In the Lead Belt, the formation has an approximate thickness of from 375 to 400 feet.

ELVINS GROUP.—The Elvins group, which consists of the Davis and Derby-Doerun formations, is a readily recognizable unit anywhere in the state. The lower part is shaly in the Lead Belt area but becomes predominantly dolomitic to the south. The upper part of the Elvins consists of fine-grained, thin- to medium-bedded, shaly dolomite.

Davis formation.—The Davis is the lower of the two formations which make up the Elvins group. The formation is conformable with the underlying Bonneterre and contains shale, siltstone, fine-grained sandstone, dolomite, and limestone conglomerate; shale is more prevalent in the Lead Belt than elsewhere. Much of the siltstone and fine-grained sandstone is glauconitic and has a "salt and pepper" appearance.

An important marker in the Davis is the *Eoorthis* brachiopod zone which is usually confined to a bed 1 or 2 feet thick that lies 30 or 35 feet below the top of the formation.

"Flat-pebble" and edgewise conglomerates are characteristic of the Davis. The "flat-pebble" conglomerates consist of rounded disclike pebbles of fine-grained limestone that are embedded in a medium-grained limestone matrix. The pebbles lie with their flat surfaces more or less parallel to the bedding planes. In the imbricate or edgewise conglomerates, the discs or lenses of fine-grained limestone are generally arranged with their longer axes perpendicular to or steeply inclined to the bedding planes. In some places, a group of edgewise pebbles will form a radiating or fanlike pattern.

Rounded, boulder size masses of light-colored, fine-grained, mottled limestone are present about 60 feet below the top of the Davis in the Lead Belt area. This horizon is informally referred to as the "Marble boulder bed".

The formation averages 170 feet in thickness. Its maximum recorded thickness is 225 feet. It thins to a featheredge wherever it onlaps Precambrian knobs.

Derby-Doerun formation.—The Derby and the overlying Doe Run formation were originally defined in 1908 from exposures in the vicinity of mines operated by the Derby Lead Company and the Doe Run Lead Company in the Lead Belt area at that time. However, the conformable relationship and similar lithology of the two units has since led most stratigraphers to consider them as a single unit, and the